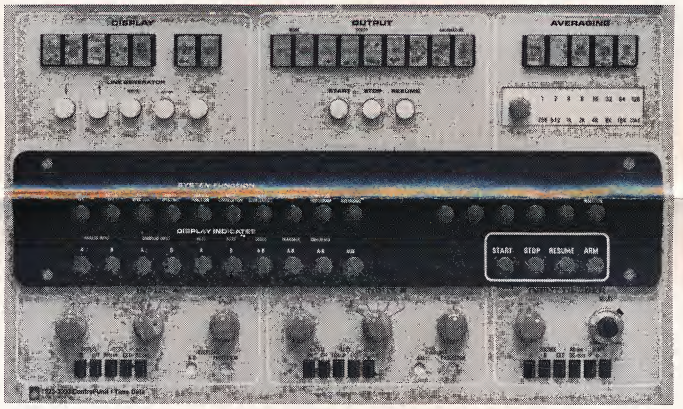
Time/Data
A GR COMPANY

NEW APPLICATIONS FOR TSA

Are you among the small, highly-qualified group of people who are familiar with the important and growing field of Time Series Analysis? Or are you in any way involved in Vibration Testing? The enclosed booklet outlines the benefits of applying TSA to vibration control and analysis. The data sheet reviews for you the specs on TIME/DATA's Model 1923 Time-Series Analyzers. There's a lot more information available for the asking. Just fill out and mail the postage-paid (in U.S.A.) reply card inside the back cover of the booklet.

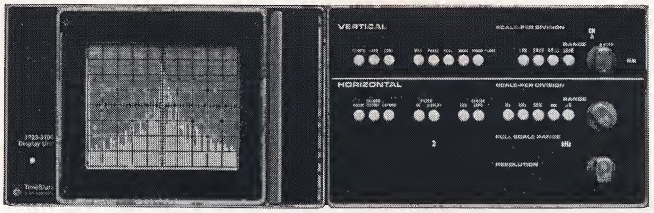
Be in command of your time-series analyzer

Time/Data saves you valuable time with single, pre-programmed pushbuttons for all widely used functions. No program. No keyboard. No human error. Just a button.

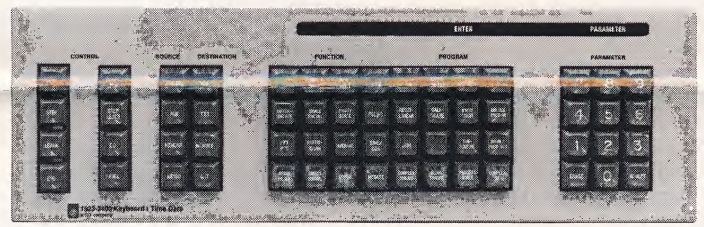


Single, pre-programmed pushbuttons for all these functions:

Direct Fourier Transform	*Auto Spectral*	*Waveform Averaging*	*Spectral Averaging*
Inverse Fourier Transform	*Cross Spectral*	*Auto Correlation*	*Linear*
	Transfer Function	*Cross Correlation*	*Exponential*
	Coherence Function	*Hanning*	*Normalized*



Full, calibrated 24, 48, or 96 dB display (pushbutton selectable)



Of course, if you wish to construct additional functions or a program of your own, use our plug-in keyboard. It utilizes a high-level language for time-series functions, arithmetic functions, and digital processing. It can even call the pre-programmed control panel functions for added speed and simplicity.

There are still more convenience features in every TIME/DATA 1923 system. See them in action. Write or call your nearest General Radio sales engineer, or GR Concord, Mass. 01742, or Time/Data, 490 San Antonio Road, Palo Alto, Calif. 94306; Europe, write General Radio, Postfach CH 8034, Zurich, Switzerland.

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490 SAN ANTONIO RD., PALO ALTO, CALIFORNIA 94306 • 415 327-8322

BOSTON 617 646-0550 / CHICAGO 312 992-0800 / LOS ANGELES 714 540-9830
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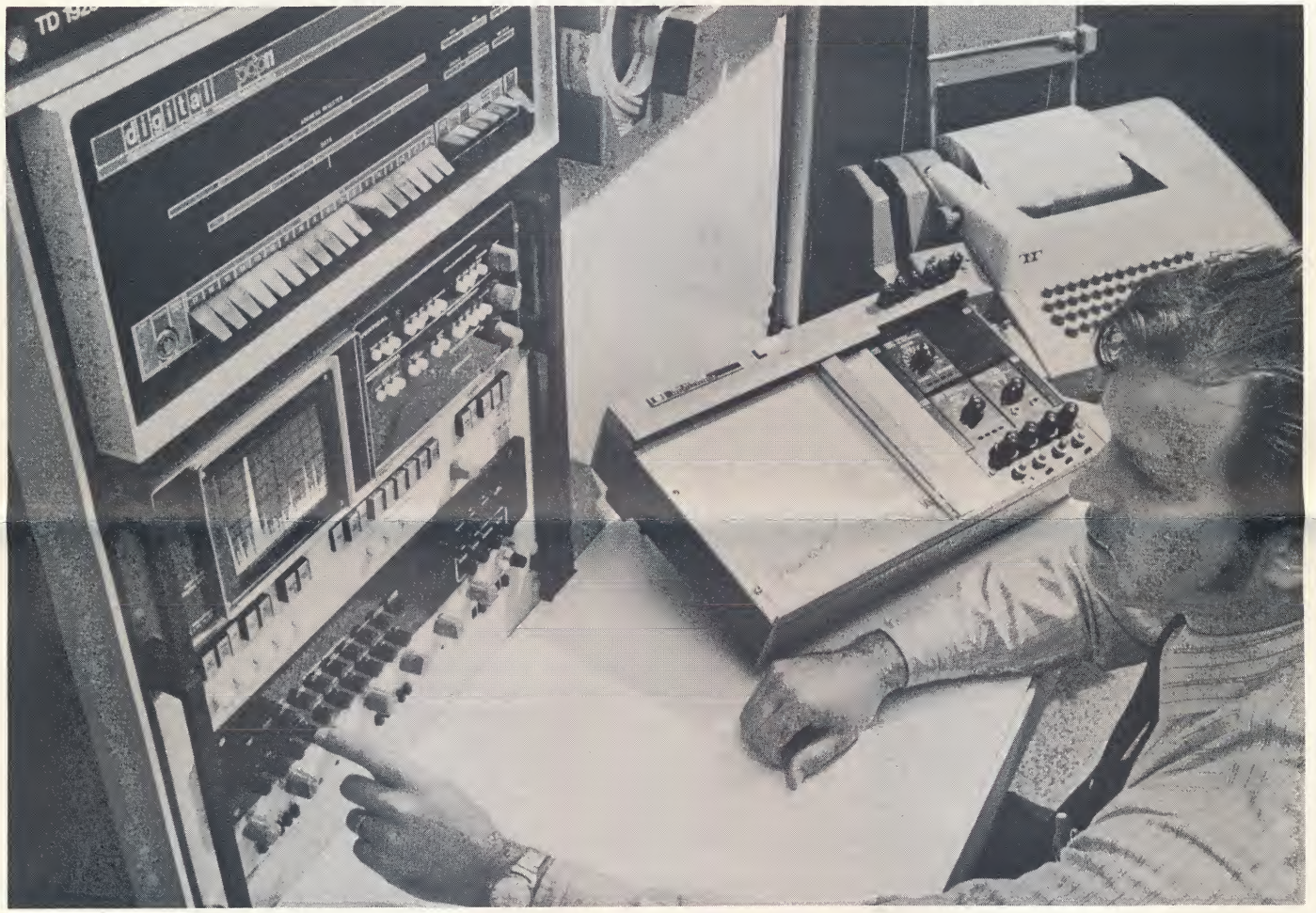
TORONTO 416 252-3395 / ZURICH (051) 47 70 20

T/D 1923 TIME-SERIES ANALYZERS



THESE ANALYZERS REPRESENT THE MOST CAPABLE, SOPHISTICATED SIGNAL-PROCESSING EQUIPMENT AVAILABLE ANYWHERE.

- **0-TO-50 kHz FREQUENCY RANGE**
- **DYNAMIC RANGE > 70 dB**
- **FREQUENCY RESOLUTION TO 0.025%**
- **AUTOMATIC ANALYSIS**
- **FULLY CALIBRATED DISPLAYS**
- **CONTINUOUS, ON-LINE REAL-TIME ACQUISITION MODE**
- **PANEL-CONTROLLED OR KEYBOARD PROGRAMMED**

TAILORED ANALYSIS The TIME/DATA 1923 analyzers provide a broad range of time series analysis techniques. Pushbutton selection of such operations as direct or inverse FFT, correlation, Auto Spectrum (P.S.D.), transfer function, etc., allow fast, error free and continuous measurements of your input signals. The analyzers are offered in four basic models to suit widely divergent needs. Each model can be tailored to your specific application either by a variety of off the shelf options, or special hardware or software unique to your installation — all fully integrated into a unified system.

Two models combine the speed of a microprogrammed Fast Fourier-Transform processor with the flexibility of a digital controller. Another owes its increased speed to the new FTE-10 Fourier Transform Extended Performance Element developed by TIME/DATA, With this wide choice you need only purchase the performance and speed you really require. If in the future your needs change you can, by adding the FTE-10 or the 90 C or 90 A processor, increase the performance to meet the needs. All models include a full software package and, in addition, custom programming is available for specialized needs.

HIGH SPEED ANALYSIS These analyzers permit real-time continuous processing without any loss of your data. Processing bandwidths are available up to 38 kHz (auto spectrum) directly from the panel. In addition, the full scale frequency range selection is in sequence steps of 1, 2, 2.5, 4, and 5 from .1 Hz to 50 kHz to allow maximum utilization of the bandwidth capability. Widest useful dynamic range is preserved by means of 16-bit words, double-precision calculations, and operator selected dynamic scaling.

EASY ANALYSIS A task-oriented control console, meaningful displays, and a complete software package provide true "one-button" operation — there is no need to know or to learn computer programming and no need for constant cable patching or control manipulation.

COMPLETE ANALYSIS The system design allows you to construct any desired compound processing and input/output operations for automatic or repetitive data-reduction routines. Parallel processing in both the processor and controller permits wide-band performance. Complex, repetitive sequences can be initiated automatically or at the push of a button, which eliminates the need for a trained operator to set up and supervise each measurement.

PRE-PROGRAMMED PUSHBUTTON FUNCTIONS

DIRECT/INVERSE FFT
AUTO-/CROSS-SPECTRUM
TRANSFER/COHERENCE FUNCTION
AUTO-/CROSS-CORRELATION
AMPLITUDE HISTOGRAM
WAVEFORM AVERAGING
Preselected time-domain HANNING available for any function

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TD 1923–572

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T/D 1923 SERIES SPECIFICATIONS

INPUT FRAME (words or points)	PROCESSING TIME (mS) FFT Dir or inverse		AUTO SPECTRUM (P.S.D.)		CROSS SPECTRUM		PROCESSING MAX BANDWIDTH (kHz) AUTO SPECTRUM	CROSS SPECTRUM	FRAME SIZE (words) SINGLE CHANNEL (optional to 8192)	DUAL CHANNEL (optional to 4096)
	128	1024	128	1024	128	1024	1024	1024		
1923/30	85	950	85	950	160	1800	0.5	0.2	2048	1024
1923/50	13	146	19	215	32	360	2.3	1.4	2048	1024
1923/70	1.7	17	2.1	22	4.8	48	20	10	4096	2048
1923/90	1.2	12.2	1.2	12.6	2.7	27	38	18	4096	2048

DYNAMIC RANGE : **> 70 dB voltage or power**

FREQUENCY RESOLUTION:

(size in words)	Frequency Lines	Resolution per Line in Hz Analysis Frequency Range in Hz** 10,000	20,000	25,000	40,000	50,000
8192*	4096*	2.5*	5*	6.25*	10*	12.5*
4096*	2048*	5 *	10*	12.5 *	20*	25 *
2048	1024	10	20	25	40	50
1024	512	20	40	50	80	100
512	256	40	80	100	160	200
256	128	80	160	200	320	400
128	64	160	320	400	640	800
64	32	320	640	800	1280	1600

*May be optional. **For lower analysis frequencies, divide Resolution per Line by appropriate power of 10.

ON-LINE INPUT: automatically set up and controlled by selected operations. Buffered mode for continuous acquisition assumed unless inhibited.
- Parallel, two-channel 10-bit A-D converters with input impedance of 1 MΩ shunted by <45 pF
- Simultaneous two-channel sampling up to 102.4 kHz (50 kHz bandwidth per channel)
- Calibrated attenuators in 1, 2, 4 steps for ranges from ±0.1V to ±2V
- AC/DC coupling
- Over range indication
- Programmable Anti-Alias Filters (optional) automatically set by selected bandwidth

CONTROL MODES
- Simple PANEL operation with pushbutton preselection of process parameters and complete operation from input start to result display on a single execution command.
- KEYBOARD (optional) operation for individual process steps and data manipulations.
- LEARNED PROGRAM mode for single command execution of complex operational sequences entered from the keyboard.

ADDITIONAL KEYBOARD FUNCTIONS
- Block (array) arithmetic: ADD, SUBTRACT, MULTIPLY, DIVIDE, BINARY SCALING, EXPONENTIAL AVERAGING all in REAL or COMPLEX mode, single or double precision.
- INTEGRATE/DIFFERENTIATE
- DECIMATE/EXPAND
- LINEAR/LOG, POLAR/RECTILINEAR conversions
- SINE/COSINE tables available for manipulations
- DIRECT CONVOLUTION
- Spectral Smoothing or time domain filtering with complex or real modes

SYSTEM CONTROLLER: DEC PDP-11, 16-bit general purpose computer with hardware multiply/divide

CONTROLLER MEMORY: 16-bit x 8K word standard (2K data area). Up to 28K word optional.

HARDWARE PROCESSORS:

1923/30	1923/50	1923/70	1923/90
PDP-11	T/D FTE-10	T/D 90C	T/D 90A

FFT PROCESSOR MEMORY: none needed in the 1923/30 or/50 systems. 4K standard with up to 16K optional in the 1923/70 or 1923/90.

ARITHMETIC: 16-bit, fixed-point for Fourier Transform; 32 bits for Auto (Power) Spectrum; double-precision selectable for many operations.

DISPLAY OPERATIONS: 8 x 10 cm CRT, with optional storage capability, completely and accurately calibrated by digital process with panel indication of scales and units.
- ANALOG mode for monitoring inputs and trigger conditions
- SAMPLED INPUT or RESULT displays
- LINEAR or LOG scales either axis
  - Vertical presents full 96 dB computational range or choice of two expanded ranges
- Complex data in choice of:
  - Cartesian REAL, IMAGINARY
  - Polar MAGNITUDE and PHASE
  - PHASE PLANE, real vs imaginary
- VERTICAL EXPANSION by linear scaling or log range shift in 6 dB steps over full double-precision range
- HORIZONTAL EXPANSION of any portion of full scale range.

MULTIPLE FRAME AVERAGING **1–16K frames, or CONTinuous with pushbutton selection of:**
- UNIFORM WEIGHT ACCUMULATION
- EXPONENTIAL DECAY of older results, with adjustable discount factor
- NORMALIZING if desired
- OVERFLOW PROTECTION AND WARNING

POWER: 110 to 125 or 220 to 250 V, 50 or 60 Hz.

MECHANICAL: WEIGHT: 1923/70/90, 1200 lb (544 kg) net; 1923/30/50, 675 lb (306 kg) net.

BASIC SYSTEM

1923–9722 T/D 1923/30 Time series analyzer
1923–9724 T/D 1923/50 Time series analyzer
1923–9726 T/D 1923/70 Time series analyzer
1923–9728 T/D 1923/90 Time series analyzer

OPTIONS

Recommended for complete functional system

–07 ASR-33 Teletype
–20 70" Rack Cabinet
–50 Keyboard and Keyboard Control Software
–56 Program-controlled Anti-Alias Filter
–57 High-speed (300 cps) Paper Tape Reader

Other standard options

There are over 60 standard options consisting of additional memory segments for the processor or controller; special software; output devices such as X-Y plotters, recorders, storage oscilloscope, etc.; magnetic tape or disk units, and many more.

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